

AD-A174 724 MORPHOLOGICAL CHANGES IN A LARGE SUNSPOT GROUP BEFORE A 1/1
SOLAR FLARE DURING AUGUST 1972(U) NAVAL OCEAN SYSTEMS
CENTER SAN DIEGO CA Z B KOROBKOVA ET AL 23 JUL 77

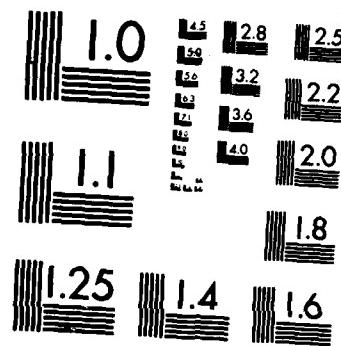
UNCLASSIFIED

F/G 3/2

NL

NOSC





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Q

NOSC

NOSC / TD 125

NOSC / TD 125

Technical Document 125

MORPHOLOGICAL CHANGES IN A LARGE SUNSPOT GROUP BEFORE A SOLAR FLARE DURING AUGUST 1972

AD-A174 724

Translated by CM Bigger from an article by ZB Korobova
Edited by MP Bleiweiss

23 June 1977

DTIC
ELECTED
S DEC 03 1986 D

Approved for public release; distribution is unlimited

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

86 12 02 170



NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND
RR GAVAZZI, CAPT, USN

Commander

HOWARD L BLOOD, PhD

Technical Director

ADMINISTRATIVE INFORMATION

This document was translated and edited under Program Element FGOV, Project O, Task NASA (NOSC M229). The work was accomplished during June-July 1977 and the document was approved for publication 14 September 1977.

Released by
Dr JH Richter, Head
EM Propagation
Division

Under authority of
JD Hightower, Head
Environmental Sciences
Department

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

~~AD-A174 714~~

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS			
2a. SECURITY CLASSIFICATION AUTHORITY UNCLASSIFIED		3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.			
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		5 MONITORING ORGANIZATION REPORT NUMBERS			
4 PERFORMING ORGANIZATION REPORT NUMBER(S) NOSC TD 125		7a. NAME OF MONITORING ORGANIZATION			
6a. NAME OF PERFORMING ORGANIZATION Naval Ocean Systems Center	6b. OFFICE SYMBOL (if applicable)	7b. ADDRESS (City, State and ZIP Code) San Diego, CA 92152-5000			
8a. NAME OF FUNDING/SPONSORING ORGANIZATION National Aeronautics and Space Administration	8b. OFFICE SYMBOL (if applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER			
8c. ADDRESS (City, State and ZIP Code)		10 SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO. FГОV	PROJECT NO. 0	TASK NO. NASA	AGENCY ACCESSION NO.
11 TITLE (include Security Classification) MORPHOLOGICAL CHANGES IN A LARGE SUNSPOT GROUP BEFORE A SOLAR FLARE DURING AUGUST 1972					
12 PERSONAL AUTHOR(S) Z. B. Korbova Edited by MP Bleiweiss					
13a. TYPE OF REPORT	13b. TIME COVERED FROM <u>Jun 1977</u> TO <u>Jul 1977</u>	14 DATE OF REPORT (Year, Month, Day) 23 July 1977	15. PAGE COUNT 4		
16. SUPPLEMENTARY NOTATION This document is a translation by C.M. Bigger from an article in Solar Data (Solnechnye Dannye) May 1974, pp 92-95, published by the Main Astronomical Observatory of the USSR Academy of Sciences.					
17 COSATI CODES		18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Morphological changes Sunspot groups Solar flares			
FIELD	GROUP	SUB-GROUP			
19 ABSTRACT (Continue on reverse if necessary and identify by block number) *This document investigates morphological changes in sunspot groups during solar flares. Using phot heliograms taken previously, the investigators traced the fast changes in the morphology of the main sunspot umbrae for the flare active group No. 223. A comparison of the phot heliograms divided into intervals of a few hours showed that although the overall area of the sunspot was extremely stable, the contours of the umbrae and their configurations were changing noticeably.					
20 DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL J.H. Richter			22b. TELEPHONE (Include Area Code) (619) 225-7919	22c. OFFICE SYMBOL Code 54	

DD FORM 1473, 84 JAN

83 APR EDITION MAY BE USED UNTIL EXHAUSTED
ALL OTHER EDITIONS ARE OBSOLETEUNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

TECHNICAL DOCUMENT 125

MORPHOLOGICAL CHANGES IN A LARGE SUNSPOT GROUP
BEFORE A SOLAR FLARE DURING AUGUST 1972

ZB Korobova

Solar Data (Solnečnye Dannye) May 1974, p 92-95, Published by the
Main Astronomical Observatory of the USSR Academy of Sciences

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution / _____	
Availability Codes	
Dist	Avail a d/or Special
A-1	1

LA POSTA ASTROGEOPHYSICAL OBSERVATORY



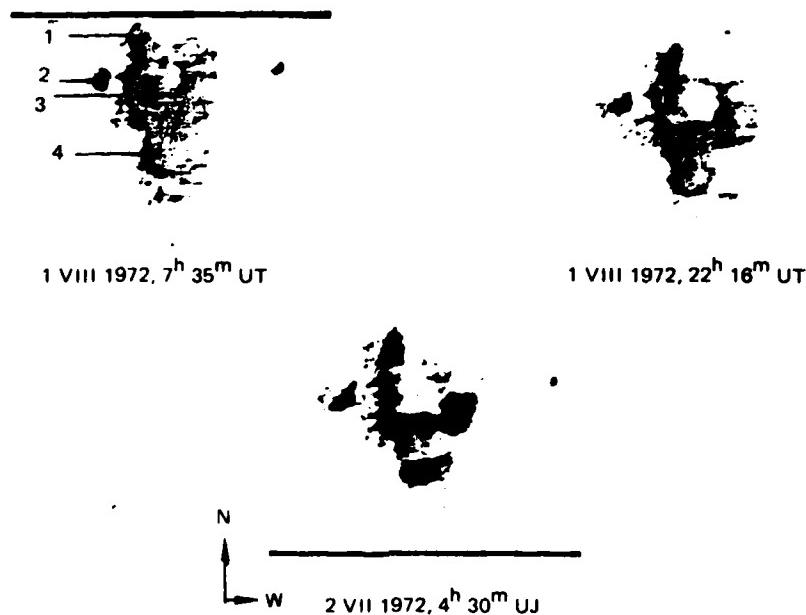
The question of morphological changes in sunspot groups during solar flares has been examined by many investigators.¹⁻³ It has been established through photoheliograms taken before and after a flare that it is possible to detect material changes in the configuration and area of the main sunspots as well as the appearance and disappearance of satellite spots.

Having at our disposal photoheliograms taken in Tashkent, Kislovodsk, and Ussurijsk during the period from 1 through 8 August, we decided to trace the fast changes in the morphology of the main sunspot umbrae for the flare active group No 223* having δ-configuration.

A comparison of photoheliograms divided into intervals of a few hours showed that although the overall area of the sunspot was extremely stable, the contours of the umbrae and their configurations were changing noticeably.⁴

Among the deformations having a gradual evolutionary character, our attention was attracted to one case of abrupt changes which took place in a region of S-spot polarity and which preceded a series of powerful flares on August 2, 1972. The first of these was registered at 3^h 16^m UT and had a range of 1N - 2N.⁵ Before August 2 flares exceeding 1N had not been observed in the group.

The photoheliogram prints are presented in Ill. 1. The first of these was taken 24 hours before the flare which began at 3^h 16^m, the second was made 5 hours before it began, and the third close to its maximum intensity. The diameter of the sun's image on the prints equaled 50 cm. The umbrae of S-polarity (those which were leading in the given hemisphere) have been enumerated.

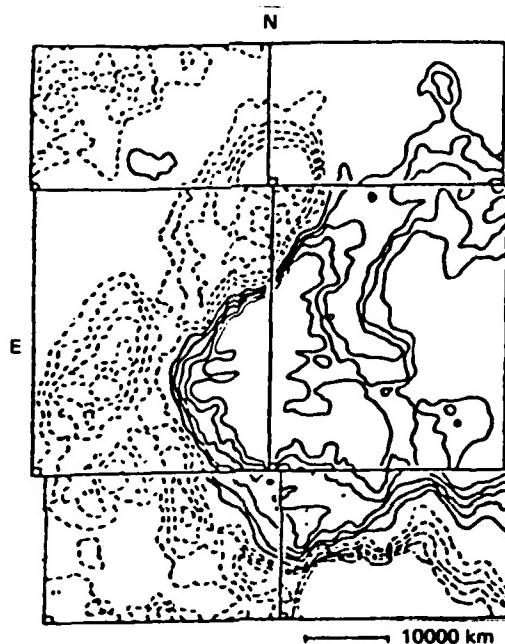


Ill. 1. From ZB Korobova's article (ref 4)

* Enumerated according to the Solar Data Bulletin.

1. SI Gopasjuk i dr, Izv KrAO, 29, 15, 1963
2. MJ Martres et al, IAU Symp N 35, 318, 1968
3. R Michard, IAU Symp N43, 359, 1971
4. ZB Korobova, Soln dannye, No 4, 1974
5. Report UAG-28, Part 1, 19, 1973

As the prints show, a few hours before the flare (see the photoheliogram taken on 1 August 22^h 16^m UT) umbra #3 disappeared, having separated prior to this from the large N-umbra by means of a thin penumbral bridge. The remainder of the S-umbra contracted in size, while the area of umbra #4, counted at 7^h 35^m as 44 m.s.h., diminished in size to 23 m.s.h. The deformation of this umbra is of the greatest interest. The umbra assumed an oval form in place of its circular form at 7^h 35^m. When comparing the print taken at 22^h 16^m with the longitudinal magnetic field map for August 2 (borrowed from ref 6, and presented in Ill. 2), it becomes obvious that contraction of umbra #4 occurred in a direction perpendicular to the position of line $H_{||} = 0$, separating this umbra from the umbra of n-polarity. Umbra #1 and #2 were also stretched slightly along the line that divided the polarities, but this contraction is masked by perspective shortening. A narrow appendage which skirted line $H_{||} = 0$ appeared by umbra #1.



Ill. 2. (ref 6)

All of these morphological changes undoubtedly testify that the flare on August 2, which was followed by a whole series of flares in the range of 2 and 3 (among them four proton flares), was preceded by tangential movements in the photosphere, umbral deformation, and a pressing of the umbrae toward the neutral polarity line.

In the N-field region material changes did not occur in the umbral form or area. Here the most noticeable changes were in the fibrous structure of the penumbra of the northern portion of the spot. For the analysis of these changes, more frequent prints are needed.

At the moment when the 3rd photoheliogram was received (between two successive flare maximums⁵), the sizes of the umbrae were reestablished (see lower table) and umbra #4 again assumed a circular form.

6. Report UAG-28, Part 1, 97, 1973

DATE	TIME UT	ΣS_{τ_S}	ΣS_{τ_N}	F_S	F_N	$F_N - F_S$	$F_N + F_S$	k (%)
I VIII 1972	7 ^h 35 ^m	97.0	152.8	2457	3901	1444	6358	23
I	22 16	55.5	149.1	1569	4579	3010	6148	49
2	4 38	90.3	153.5	2575	4721	2146	7296	29

The table contains values for the total area of the umbrae of differing polarity and for the magnetic fluxes of the corresponding umbrae.

For the measurement of umbral area, photoheliograms were projected on the screen of a coordinate-measuring device UIM-23* having 12 power magnification, and a transparent millimetre graph-network was then superimposed upon the image. The error limits for the determination of the area did not exceed 10%. The area is expressed in m.s.h. The magnetic flux values for the sunspots are calculated according to the formula $F = FS_{\tau}$, where H is taken from reference 7.

The table shows that for a few hours before the flare the excess of flux with n-polarity over s-polarity doubled. AB Severnyj has repeatedly noticed an increased difference in magnetic fluxes in an active region prior to a flare.⁸ This occurred before the August 2 flare due to an abrupt diminution and contraction of the sunspot's S-umbra.

The values of the coefficient $K = \frac{F_n - F_s}{F_n + F_s}$ are presented in the last column of the table as a quantitative characteristic "imbalance" of the fluxes as proposed² and again as in reference 2 the onset of the flare was preceded by an increase in K.

In conclusion, the author expresses his deep gratitude to VI Makarov and VF Cistjakov for the photoheliograms submitted.

* Translator's note: Universal measuring microscope

7. Magnitnye polja solnečnyx pjaten Priloženie K bjull "Soln dannye", No 8, 1972

8. AM Zvereva, AB Severnyj, Izv KrAO, 41-42, 97, 1970

REFERENCES

1. SI Gopasjuk i dr, Izv KrAO, 29, 15, 1963
2. MJ Martres et al, IAU Symp. N 35, 318, 1968
3. R Michard, IAU Symp N 43, 359, 1971
4. ZB Korobova, Soln dannye, No 4, 1974
5. Report UAG-28, Part 1, 19, 1973
6. Report UAG-28, Part 1, 97, 1973
7. Magnitnye polja solnečnyx pjaten. Priloženie K. bjull. "Soln dannye", No 8, 1972
8. AM Zvereva, AB Severnyj, Izv KrAO, 41-42, 97, 1970

Astronomy Institute
Acad Sci Uzbek SSR

Submitted for Editing 22 April 1974

E

W

D

A 87

D T / C